

immunisation consists in the subcutaneous inoculation of some mysterious bacterial fluid prepared in the laboratory. On the contrary, it is a complex process, and it is only with the help of accurate scientific measuring methods that the physician will be able to gauge whether he is helping or injuring his patient. B.

PALÆOZOIC SEED PLANTS.

IT may be doubted if those who are not directly concerned with the study of the vegetable kingdom appreciate the full significance of the distinction which the botanist maintains between plants of seed-bearing and spore-bearing habit. For this reason the recent and important discoveries proving that the seed-bearing habit existed among more than one group of Palæozoic vegetation, discoveries which will form a historical landmark in the study of fossil plants, may not attract the attention which is their due outside the circle of workers on recent and fossil botany.

The seed-bearing habit is, from many points of view, regarded as a far higher stage in plant evolution than that attained by any known member of the vegetable kingdom in which the fertilised megasporangium remains without any integument of the nature of a seed-coat. So far, the botanist has associated the seed habit with two classes of plants, the gymnosperms (Coniferæ, Cycadææ, &c.) and the angiosperms or flowering plants, and with these alone. It has not been suspected that members assigned to other groups, including the great race of vascular cryptogams (Pteridophyta), had at any period in their evolution attained to this high status. Yet such has recently been shown to be the case.

It is interesting to notice that these discoveries have been mainly due to the British school of palæobotany. Although it has been known for a long period that remains, obviously of the nature of seeds, occur here and there in the sandstones and shales of the Carboniferous period, Carruthers was the first to suggest, in 1872, that some of these fossil seeds may be attributed to the genus *Cordaitea*, an extinct race, of gymnospermous affinities. This conclusion was subsequently confirmed by Geinitz, Grand'Eury, Renault, and other Continental botanists, who have greatly extended our knowledge of this Palæozoic type.

Until recently *Cordaitea* has remained the solitary Palæozoic genus which was known to have attained the seed-bearing habit.

In 1901, however, Dr. Scott published a full description of a Carboniferous cone, *Lepidocarpon*, of undoubted lycopodian affinities, where integumented megasporangia are found when fully mature, and in which each sporangium contains a single embryo-sac. It has thus become clear that in the history of the lycopodian stock the evolution of seed-bearing members had taken place. More recently other evidence has accumulated which not only confirms this conclusion, but tends to show that *Lepidocarpon* did not stand alone among lycopods in this respect.

It is to discoveries still more recent of a similar nature, but affecting other lines of descent, that special attention may be directed. They are concerned with a synthetic type of Upper Palæozoic vegetation of great interest, which has become widely known under the name *Cycadofilices*. More than one genus of this group has now been shown to have reached the seed-bearing status.

The credit of the first discovery of this nature is due to Prof. Oliver and Dr. Scott, who recently published a full account of the seed and the evidence for its attribution in the *Philosophical Transactions* of the Royal Society. The more important conclusion of these authors may be briefly summarised as follows. It has been found that a seed, already recorded by Williamson as *Lagenostoma Lomaxi*, was borne by the fossil plant known as *Lyginodendron*. The two have not been found in continuity, but the evidence for this conclusion, although in the main indirect, is none the less conclusive. The chief point lies in the identity of the glandular structures found on an organ termed the "cupule," which envelops the seed, with those already known to occur on the stems, petioles and pinnules of *Lyginodendron*, which are peculiar to this genus among Carboniferous plants.

Within a few months of the earlier record of this re-

markable research by Prof. Oliver and Dr. Scott, their main conclusion was confirmed in an unexpected manner by the discovery, on the part of Mr. Kidston, of the seed of another genus of the same group, *Medullosa*, of which an account has also appeared in the *Philosophical Transactions*. In this case the pedicel of a large seed, of the type known as *Rhabdocarpus*, was found to bear pinnules identical with those of the frond *Neuropteris heterophylla*, the foliage of a *Medullosa*.

Here absolute continuity, an extremely rare circumstance among fossil plants, exists between a foliar and a reproductive organ.

Further evidence, but more inconclusive and indirect, also exists, but space forbids any notice here. Attention may, however, be directed to an interesting and suggestive communication published by M. Grand'Eury in the *Comptes rendus* during the present year on the same subject.

The discoveries under discussion have made it clear that at least two genera of the *Cycadofilices* possessed the seed-bearing habit, and evidence is also available which suggests that *Lyginodendron* and *Medullosa* did not stand alone in this respect.

Prof. Oliver and Dr. Scott have concluded that "the presence in the Palæozoic flora of these primitive, Fern-like *Spermophytes*, so important as a phase in the history of evolution, may best be recognised by the foundation of a distinct class which may suitably be named *Pteridospermeæ*." This suggestion would seem to be a happy one, even though it may eventually involve the absorption of the whole group now familiar as the *Cycadofilices*.

In connection with these researches of Prof. Oliver, Dr. Scott, and Mr. Kidston, many further points of interest, and in some cases of criticism, might be discussed, but it must suffice here to direct attention to one or two valuable clues which these discoveries afford. The phylogeny of the cycads, a race with a great past, and still existing though in greatly diminished numbers, is in its main outlines now clear. There can be little doubt that the cycads are sprung from this same pteridospermous stock, which in its turn originated from a truly fern-like ancestor.

In the investing envelope of the young seed of *Lagenostoma*, which Prof. Oliver and Dr. Scott have spoken of as the "cupule," it is not improbable that homologies may eventually be recognised with protective structures existing among members belonging to other lines of descent, which may have great value as a contribution to other phylogenetic problems.

In conclusion, the existence of the seed-bearing habit among certain members of three out of the six great groups of Upper Palæozoic times raises the interesting speculation whether other groups may not eventually be found to have attained to the same status. The *Calamites*, the representatives of the *Equisetales*, are at present above any real suspicion in this respect, yet it would now be hardly surprising if further discoveries revealed the existence of seed-bearing members in this group, although it is by no means safe to assume that the seed-bearing habit must necessarily have existed in any group. E. A. N. ARBER.

ANTHROPOLOGICAL NOTES.

THE *Reliquary and Illustrated Archaeologist* for October contains, as is usual with this journal, interesting and well illustrated articles, among which may be noted one on "the funambulist," or rope-walker, by Mr. Arthur Watson; some Norman and pre-Norman remains in the Dove-Dale district, by Mr. G. le Blanc Smith; medallic portraits of Christ in the sixteenth century, by Mr. G. F. Hill; a carved bone of the Viking age, by Mr. J. Romilly Allen.

All who are interested in primitive technology will welcome the new instalment of Dr. Walter E. Roth's monograph on North Queensland ethnography. *Bulletin* No. 7 deals with domestic implements, arts, and manufactures, and is illustrated by twenty-six plates containing 250 figures. Dr. Roth not only describes the objects in daily use of the Queensland blacks, but, what is of very much greater importance, he usually describes how and of what they are made. Of especial interest and importance is his description of the manufacture of stone implements. He says:—

"I am afraid that too much importance has been hitherto attached to the differentiation of stone-celts into axes, adzes, wedges, scrapers, &c.: the savage certainly does not recognise the fine distinctions embodied on the labels attached to these articles in an ethnological museum. . . . The actual manufacture of a celt is now a lost art in Queensland. . . . The original celt in its simplest form is a water-worn pebble or boulder, an adaptation of a natural form; otherwise, it is a portion removed from a rock, &c., *in situ*, either by fire, indiscriminate breakage or flaking."

A record of a careful excavation of Jacob's Cavern, McDonald County, Missouri, by Messrs. Charles Peabody and W. K. Moorehead, is given in *Bulletin* i., department of archæology, Phillips Academy, Andover, Mass. The implements are of well known types, and nothing suggestive of Palæolithic culture was discovered; it is possible that the cave-dwellers were different from the Osages and from the lower Mississippi tribes. The paper is illustrated by eleven plates. The Phillips Academy is to be congratulated on its activity.

An interesting and well illustrated *résumé* of the recent archæological discoveries in Crete is given by M. S. Reinach in *l'Anthropologie* (Tome xv., Nos. 3-4, p. 257). The author tentatively proposes the following chronology of the development of the Cretan civilisation:—(1) 4500 (at least) to 2800, Neolithic period. Black pottery, with angular designs and no spirals; numerous stone vessels; no metal; rudimentary figurines of burnt clay. (2) 2800 to 2200, period of Kamares or Minoan I. About 2800 first certain contact with Egypt (twelfth dynasty); introduction of copper and bronze into Crete; painted pottery derived from Neolithic pottery. (3) 2200 to 1900, period of transition or Minoan II. Building of first palace. Continuation of relations with Egypt and commercial dealings with the islands of the Archipelago, notably with Melos. (4) 1900 to 1500, culmination of the period of Kamares or Minoan III. Building of the second palace; great development of ceramics, glyptics, and painting. An artist of Knossos went to Phylakopi, in Melos, and executed the "flying-fish fresco"; the linear Cretan writing occurs on Melian pottery. An insular confederation (?) took possession of Knossos and there established a new dynasty (?). (5) 1500 to 1200, Mycenaean period. Ceramics with zoomorphic and curvilinear designs. The centre of civilisation passed to the Peloponnesos; decadence and abandonment of the palace. The last king of the Minoan dynasty, Idomeneus, left Crete about 1200 for Italy, and founded Salentium; shortly afterwards the Dorians conquered Crete, and the island entirely retrogressed into barbarity.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The report of the studies and examinations syndicate on the previous examination, in which it is proposed that a modern language may be substituted for Greek or Latin, will be discussed in the Senate House on December 1.

Dr. H. F. Baker, F.R.S., St. John's, and Mr. F. H. Neville, F.R.S., Sidney, have been appointed members of the general board of studies. Prof. J. J. Thomson, F.R.S., has been appointed a manager of the Gerstenberg studentship in moral philosophy for students of natural science.

Dr. Myers has been appointed demonstrator of experimental psychology.

The Isaac Newton studentship in astronomical physics and optics, value 200*l.* a year for three years, will be vacant next term. Candidates must be B.A.'s of the university, and under twenty-five years of age on January 1, 1905. Application is to be made to the Vice-Chancellor before January 26.

Additional benefactions to the university, amounting to some 3500*l.*, have been paid or promised since February of the present year. A considerable number are ear-marked for the endowment of a Huddersfield lectureship in special pathology.

Two Walsingham medals in biology have been awarded this year, one to Mr. R. P. Gregory, fellow of St. John's College (for botany), and one to Mr. K. Lucas, fellow of Trinity College (for physiology).

New buildings of the Borough Polytechnic Institute, including buildings for engineering, building trades, domestic economy, &c., are to be opened as we go to press by Mr. J. W. Benn, M.P., chairman of the London County Council.

LORD REAY will deliver the prizes at the Northampton Institute for the session 1903-4 on Friday, December 9, at 8 o'clock. The prize distribution will be followed by a conversazione, which will be continued on Saturday, December 10.

DR. FREDERIC ROSE, His Majesty's Consul at Stuttgart, and the author of a series of diplomatic and consular reports on technical instruction in Germany, has been elected assistant educational adviser to the Education Committee of the London County Council.

THE committee in charge of the fund for the development and better equipment of the science schools in Trinity College, Dublin, has announced that 15,886*l.* has now been subscribed towards the 78,000*l.* necessary for the annual up-keep of the new schools. It will be remembered that Lord Iveagh offered to provide the sum of 34,000*l.* required to erect the new buildings if the amount required for up-keep were obtained by public subscription. The committee, in making an earnest appeal for further subscriptions, points out that the next most urgent need of the university is the development of the school of botany and plant physiology.

It may be taken as indicative of the widespread interest in higher education among the Welsh people that large sums of money are contributed in a great number of small amounts towards the expenses of the university colleges. For instance, in the preliminary list of subscriptions, paid or unpaid, towards the permanent buildings fund, published in the calendar of the University College of North Wales for the session 1904-5, we notice that more than 6500*l.* is made up of amounts under five pounds, and, in addition to this, there are more than two hundred gifts of five guineas or five pounds. The total amount of subscriptions up to the present towards the permanent buildings fund reaches 27,190*l.*

THE Education Committee of the County Council of the West Riding of Yorkshire arranged last summer for the attendance of a group of art-masters from the schools in their administrative area to attend for six weeks at the School of Industrial Arts, Geneva. The committee has now published extracts from the report received from the administrator of the Geneva school on the work of the Yorkshire teachers, and a summary of the reports submitted by the art-masters who studied at Geneva. The teachers seem to have benefited greatly by their visit, and there can be little doubt that a first-hand acquaintance with Continental methods is of great value to English teachers. One interesting way in which scientific observation may be rendered useful in art instruction comes out in the report of one of the visiting masters, who writes of the Geneva School of Industrial Arts that: "Another very useful adjunct is a garden where Nature is allowed to have very much of her own way. Here the form and colour of plants and flowers and their growth at various stages can be carefully and leisurely studied."

SPEAKING at the Birmingham Municipal School on Tuesday, Mr. Alfred Mosely referred to some lessons taught by the American educational system. He remarked that America differs from us in an intense belief in education, and the realisation by manufacturers of the value of the thoroughly trained college student in their factories. We are face to face with a condition of things which is somewhat alarming. A scientific education has become an absolute necessity if we are to hold our place industrially. We have an Empire such as those who have not travelled do not realise, an Empire teeming with natural resources in every direction, merely awaiting the skilled hands of the mechanic and farmer to develop them. What we have in Canada and our other colonies makes the United States pale by comparison, but the United States have learnt to develop their resources, while we have been quarrelling over the village pump. It is Mr. Mosely's intention at an early date to approach some of the steamship companies to see whether facilities can be arranged for some school teachers to visit the United States and observe what is done there.